

REMARKS

Claims 1-17 are pending in this application. Claim 8 is currently amended.

Applicants submit the following remarks and respectfully request reconsideration of the
5 application.

Rejection Under 35 U.S.C. §103

Claims 1-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S.

Pat. No. 6,629,152 to Kingsbury et al. in view of U.S. Pat No. 63,60,220 B1 to Forin.

Regarding Claim 1,

10 Claim 1 recites:

1. A processing system for performing addition and subtraction within limits upon a shared value comprising:

means for performing a first uninterruptible operation upon the shared value stored in an affected reservation location, the first uninterruptible
15 *operation using an operand;*

means for comparing a resulting value of the first uninterruptible operation stored in the affected reservation location to an upper value and a lower value to determine if the resulting value is within a range defined by the upper value and the lower value that can be changed;

20 *means for performing a second uninterruptible operation to restore the affected reservation location if the resulting value of the first uninterruptible operation is not within the range defined by the upper value and the lower value;*

25 *means for reporting a failure if the resulting value of the first uninterruptible operation is not within the range defined by the upper value and the lower value;*

means for performing a third uninterruptible operation to update an actual value location if the resulting value of the first uninterruptible operation is within the range defined by the upper value and the lower value;

30 *means for performing a fourth uninterruptible operation to update an unaffected reservation location if the resulting value of the first uninterruptible operation is within the range defined by the upper value and the lower value; and*

means for reporting a success if the resulting value of the first uninterruptible operation is within the range defined by the upper value and the lower value.

5 With regard to Claim 1, the Examiner admits:

10 Kingsbury is silent with reference to teaching a means for comparing a resulting value of the first interruptible operation stored in the affected reservation location to an upper value and lower value to determine if the resulting value is within a range defined by the upper value and lower value that can be changed; and means for reporting a failure if the resulting value of the first uninterruptible operation is not within the range defined by the upper value and lower value.

and cites Forin as teaching these limitations.

15 The Applicants traverse the rejections under 103(a) on the grounds that the cited references do not teach all of the limitations of the invention, even in combination, and also on the grounds that the Examiner has not made a prima facie case for a rejection under 103(a).

20 **First**, the teachings of Kingsbury do not include multiple limits or a comparison with a lower value, while several of the limitations of Claim 1 include multiple limits and a comparison with a lower value.

For example, the Examiner states

25 Kingsbury teaches a processing system for performing addition and subtraction (“...AFADDII...AFSUBII...” Col. 9 Ln. 42-53) within limits upon a shared value comprising: means for performing a first uninterruptible operation upon the shared value stored in an affected reservation location, the first uninterruptible operation using an operand (Mailbox Data Structure 70 Col. 7 Ln. 23-65, Col. 10 Ln. 26-27).

30 The Applicants interpret this statement as indicating that the Examiner is suggesting that Col. 9 Ln. 42-53 teaches “*performing addition and subtraction within limits*,” and that the manipulation of state variables, as taught in Mailbox Data Structure 70 Col. 7 Ln. 23-65, Col. 10 Ln. 26-27, teaches the “*first uninterruptible operation*.”

The Applicants traverse these suggestions and point out that any addition and subtraction performed by the cited text is not within “*limits*” (plural). As illustrated in Table 1 of Col. 9 of Kingsbury, the operation AFADD always involve incrementing (i.e., increasing) a variable by a value of one. (See, for example, the second line of the pseudo code in Table 1.) While this line is bounded by the size of the mail box (third line) during incrementation, this is only a single limit, not “*limits*,” (plural), and is only bounded during incrementation not subtraction. The Applicants, therefore, request that the Examiner specifically point out addition and subtraction within “*limits*,” (plural) within the cited art, or allow Claim 1 and those claims that depend therefrom.

In another example, the Examiner suggests that Kingsbury teaches each of “*means for performing a second uninterruptible operation ... if the resulting value of the first uninterruptible operation is not within the range defined by the upper value and the lower value,*” “*means for performing a third uninterruptible operation ... if the resulting value of the first uninterruptible operation is within the range defined by the upper value and the lower value,*” and “*means for reporting a success if the resulting value of the first uninterruptible operation is within the range defined by the upper value and the lower value.*” Each of these limitations, which the Examiner suggests is taught solely by Kingsbury, includes a conditional phrase (e.g., “if ...”) that is dependent on a comparison with a “*lower limit.*” The Applicants are unable to identify any such lower limit within Kingsbury as suggested by the Examiner. The Applicants therefore request that the Examiner specifically point out teachings of a lower limit and the use of that lower limit to trigger a conditional operation, or allow Claim 1 and those claims that depend therefrom.

Second, it is the position of the Applicants that Kingsbury does not teach “*means for performing a third uninterruptible operation to update an actual value location if the resulting value of the first uninterruptible operation is within the range defined by the upper value and the lower value.*” The teachings of Kingsbury cited by the Examiner as

5 teaching these limitations include neither an uninterruptible operation nor an operation that is conditional on the result of the first uninterruptible operation being within a range. Specifically, the Examiner cites Step 104 Col. 10 Ln. 58-61 of Kingsbury as teaching the above limitations. This text includes “[t]he value of the presence indicator, n_present, is then changed to indicate that a message is present in a message slot of the destination
10 mailbox data structure, waiting to be received (step 104).” The Applicants are unable to identify any teaching that the change in value of the presence indicator is uninterruptible, e.g., atomic. The Applicants are further unable to identify any teaching that performance of this step is dependent on the result of the first uninterruptible operation being within a range defined by an upper and lower limit. As the Examiner admits that Kingsbury
15 doesn’t teach a comparison of a value resulting from the first uninterruptible operation with a range defined by the upper value and the lower value, it is hard to see how Kingsbury could teach performing an operation responsive to the result of such a comparison.

The Applicants, therefore, request that the Examiner more particularly point out
20 those parts of the cited art that are thought to teach a third operation that is “*uninterruptible*,” or allow Claim 1 and those claims that depend therefrom.

Third, it is the position of the Applicants that Kingsbury does not teach “*means for performing a fourth uninterruptible operation to update an unaffected reservation*”

location if the resulting value of the first uninterruptible operation is within the range defined by the upper value and the lower value.” Regarding these claim limitations, the Examiner cites Step 98 Col. 10 Ln. 41-50 of Kingsbury. However, the only use of a limit within this text is implied in the first two lines, which include “[I]f the present value of n_reserved does not show that the mailbox data structure is full (step 92), then the method proceeds to accept the message.” Even assuming, for the sake of argument, that this text teaches a comparison with an upper limit, there does not appear to be any lower limit involved, much less a lower limit that may control whether an operation is performed or not. The Applicants, therefore, request that the Examiner specifically point out “*means for performing a fourth uninterruptible operation*” dependent on whether the result of a comparison is “*within the range defined by the upper value and the lower value,*” or allow Claim 1 and those claims that depend therefrom.

Fourth, it is the position of the Applicants that Forin does not teach the limitations:

means for comparing a resulting value of the first uninterruptible operation stored in the affected reservation location to an upper value and a lower value to determine if the resulting value is within a range defined by the upper value and the lower value that can be changed,”

as suggested by the Examiner. Regarding these limitations, the Examiner states

Forin teaches a means for comparing a resulting value of the first interruptible operation stored in the affected reservation location to an upper value and a lower value to determine if the resulting value is within a range defined by the upper value and lower value that can be changed (ST2 Col. 13 Ln. 30-58).

However, the text cited by the Examiner concerns comparing a “search address” (Col. 13 Ln. 32) with a “range defined by the starting and ending addresses,” (Col. 13 Ln. 36). The Applicants are unable to identify any teaching within Forin that the cited

“search address” is the result of an “*uninterruptible operation*,” as recited in Claim 1.

The text cited by the Examiner is part of a discussion relating to a “lookup procedure ... for locating entries ... stored in a hash table,” (Col. 12 Ln. 57-60). Thus, there does not appear to be any basis for suggesting that the “search address” is the result of an

5 “*uninterruptible operation*.” The Applicants, therefore, request that the Examiner specifically point out support within the cited for the suggestion that the “search address” of Forin teaches limitations of Claim 1, or allow Claim 1 and those claims that depend therefrom.

Fifth, it is the position of the Applicants that Forin does not teach “*means for*
10 *reporting a failure if the resulting value of the first uninterruptible operation is not within the range defined by the upper value and the lower value*,” as suggested by the Examiner. Regarding these limitations, the Examiner cites ST7 Col. 14 Ln. 24-31 of Forin. This text discussed the decrementing of an “in-use counter” if the search address is found not to be within starting and ending addresses. However, the “in-use counter” of Forin is
15 used to indicate if a particular data entry is in use or not (See Col. 13 Ln. 38-40), not the success or failure of a comparison. As taught in Col. 14 Ln. 13-23 of Forin, the in-use counter is decremented after “a thread completes use of the memory handle for an entry.” Thus, decrementation of the in-use counter may occur following the successful identification and use of a data entry and not necessarily after a failure based on a
20 comparison. Another thread, on observing a change in the in-use counter, would have no way of knowing if the change resulted in success or failure. Therefore, the text cited by the Examiner does not teach “*means for reporting a failure if the resulting value of the*

first uninterrupted operation is not within the range defined by the upper value and the lower value,” as suggested by the Examiner.

The above discussion illustrates that many of the limitations of Claim 1 are not
5 found in either Kingsbury or Forin. Therefore, it is the position of the Applicants, that even in combination, the cited art does not teach all of the limitations of Claim 1, and that Claim 1 and those claims that depend therefrom are allowable.

In addition, the Applicants traverse the combination of Kingsbury and Forin on at least two grounds. First, that the combination suggested by the Examiner is unworkable,
10 and second, that the Examiner fails to provide a proper motivation to combine the cited art as required for a prima facie case under §103(a).

The combination suggested by the Examiner includes a message passing system (Kingsbury) and attempts to improve this system by adding an ability to compare a search address with a range of address values (Forin). In Kingsbury, the Examiner suggests that
15 a state value “old_n_reserved” (Col. 9 Table 1 Ln. 2) is the resulting value of the first uninterrupted operation. This value is used to monitor a number of used mailboxes and to make sure that the set of mailboxes is not full (Table 1 Ln. 3). In contrast, the value being compared in Forin is a “search address,” (Col. 13 Ln. 32). The Examiner makes no suggestion as to how these teachings would be modified to achieve the suggested
20 combination. It is unclear to the Applicants how the “search address” of Forin could serve the function of the value “old_n_reserved” or any other state variable of Kingsbury. The use of a search address would be an impractical way to monitor the number of used mailboxes. Further, the comparison made in Forin is within a range of addresses. The

Applicants see no utility in comparing a state value used to monitor a number of mailboxes used (Kingsbury) with a range of addresses (Forin). It is, therefore, the position of the Applicants that the combination suggested by the Examiner is an unworkable combination. The Applicants request that the Examiner clarify how the combined art is to be modified in order to achieve a functional combination, or allow Claim 1 and those claims that depend therefrom.

Regarding the motivation to combine, the Examiner states:

[i]t would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Forin and Kingsbury because the teaching of Forin would improve the system of Kingsbury by providing lock free methods and systems for accessing and storing information in an indexed computer data structure by any form of concurrent execution or apparently concurrent execution provided by a computer operation system to access and store entries without requiring locks (Forin Col. 3 Ln. 31-37).

The Applicants traverse this statement.

First, Claim 1 and various embodiments of the present invention are directed to a “*system for performing addition and subtraction within limits upon a shared value comprising*,” while Kingsbury is directed toward “message passing using shared memory of a computer,” (title) and Forin is directed toward “lock-free methods and systems for accessing and storing information in an indexed computer data structure having modifiable entries,” (title). It is unclear to the Applicants how the combination of these non-analogous teachings would be obvious to one of ordinary skill in the arts. The addition of further information access and storage to Kingsbury does not appear to benefit any of the purposes of the teachings of Kingsbury, and even if combined, the cited art would result in an unworkable system unrelated to the subject matter of the current invention.

Second, it is the Applicants' position that the motivation suggested by the Examiner is achieved by Kingsbury alone and, thus, cannot serve as a motivation to combine Kingsbury with other art, such as Forin. Specifically, Kingsbury alone teaches accessing an indexed data structure, the data structure including the mailboxes and the index being taught in Ln. 9 of Table 1. This teaching is independent of Forin. It is not clear how the proposed combination would further these preexisting benefits of Kingsbury, as suggested by the Examiner, e.g., the Examiner has not shown how a combination of an address range comparison and the teachings of Kingsbury would improve Kingsbury beyond those features already taught in Kingsbury. The only benefit suggested by the Examiner is one achieved without requiring the suggested combination, and therefore cannot be used to motivate the combination.

Third, the combination suggested by the Examiner appears to be made with the benefit of hindsight and the content of the present application. The Applicants, therefore, request that the Examiner point out motivation from within the cited art or other prior art in order to make a prima facie case under §103(a), or allow Claim 1 and those claims that depend therefrom.

For at least the above reasons, the motivation for combining the teachings of Kingsbury and Forin, as suggested by the Examiner, would not cause a person of ordinary skill in the art to make such a combination. It is, therefore, the position of the Applicants that Examiner has failed to make a prima facie case for rejection under §103(a).

Regarding Claims 2, 4 and 6,

Claims 2, 4 and 6 each include limitations “*wherein the first second, third, and fourth uninterruptible operations are Lock XADD operations.*” In rejecting these claims the Examiner states, “Kingsbury teaches the first, second, third and fourth uninterruptible operations as Lock XADD operations... Col. 9 Ln. 17 – 53. This text is also cited by the

5 Examiner in relation to the first uninterruptible operation. However, the Applicants respectfully point out that Kingsbury does not teach that those operations suggested by the Examiner to teach the second, third and fourth uninterruptible operations are XADD operations. Specifically, the Examiner cites incrementation of an “n_reserved” value as the second uninterruptible operation. This operation could easily be performed using an

10 atomic INC operation rather than an XADD operation, because the value need not be read during the operation. (XADD is only necessary when reading a value while also changing it atomically.) Similarly, the values (n_present and tail index) suggested by the Examiner as being modified in the third and fourth (respectively) uninterruptible operations could be modified by an INC operation rather than an XADD operation. The

15 Applicants, therefore, request that the Examiner specifically point out teachings that those aspects of Kingsbury that the Examiner believes teach second, third, and fourth uninterruptible operations are performed using an XADD operation, or allow Claims 2, 4 and 6.

The Applicants further believe that Claims 2, 4 and 6 are allowable for at least the

20 same reasons as the claims from which they depend.

Regarding Claims 3-7:

The Applicants believe that Claims 3-7 are allowable for at least the reasons discussed herein with respect to Claim 1.

Regarding Claim 8,

Although the Examiner states that Claim 8 is rejected under §103(a), the Examiner does not present grounds for the rejection of Claim 8 under 103(a). The Applicants, therefore, request that the Examiner allow Claim 8. Further, the Applicants respectfully point out that it would be improper for the Examiner to present new grounds for the rejection of Claim 8 in a Final Office Action. Claim 8 is amended to correct grammar.

Regarding Claim 9,

Claim 9 recites:

9. *A method of performing subtraction or addition within limits, the method comprising:*
receiving an operand from a processing thread;
performing a first uninterruptible operation upon an affected reservation location, the affected reservation location including a first instance of a shared first value, the first uninterruptible operation being configured to generate a second value by subtracting the operand from or adding the operand to the first instance of the shared first value;
comparing the generated second value in the affected reservation location to one or more limit values stored in one or more limit locations;
performing a second uninterruptible operation to restore the shared first value in the affected reservation location if the second value is not within any of the one or more limit values;
reporting a failure if the second value is not within any of the one or more limit values;
performing a third uninterruptible operation to update a second instance of the shared first value stored in an actual value location if the second value is within the one or more limit values, the actual value location being a memory location shared by a plurality of processing threads; and
performing a fourth uninterruptible operation to update a third instance of the shared first value stored in an unaffected reservation location if the second value is within the one or more limit values.

Examiner states that Claim 9 is rejected on the same basis as Claim 1. However, Claim 9 includes various limitations not included in Claim 1, and not addressed by the Examiner. Specifically, Claim 9 includes at least the following limitations not found in

Claim 1: “*the affected reservation location including a first instance of a shared first value,*” “*to update a second instance of the shared first value,*” and “*to update a third instance of the shared first value.*” The Applicants respectfully request that the Examiner specifically point out teachings of these limitations within the cited art, or allow Claim 9 and those claims that depend therefrom.

Further, the above limitations refer to a first, second and third instance of the same shared first value and, in Claim 9, specify that these instances are operated on during the second, third and fourth uninterruptible operations. The Applicants note that those teachings of Kingsbury that are suggested by the Examiner to teach the second, third and fourth uninterruptible operations are performed on different values, not different instances of “*of a shared first value.*” Thus, those teachings cited by the Examiner in reference to Claim 1, cannot teach these limitations of Claim 9.

Regarding Claims 10 and 11,

The Applicants believe that Claims 10 and 11 are allowable for at least the reasons discussed above with respect to Claim 9, from which they depend.

Regarding Claim 12,

Claim 12 recites:

12. The method of claim 9, wherein the first uninterruptible operation is configured to generate the second value by adding the operand to the first instance of the shared first value.

The Examiner rejects Claim 12 on the same grounds as Claim 1. However, the Applicants respectfully point out that Claim 12 includes limitations not found in Claim 1 and not addressed by the Examiner. Specifically, Claim 1 does not include the limitations “*the first uninterruptible operation is configured to generate the second value*

by adding the operand to the first instance of the shared first value.” The Applicants are unable to identify any teaching within Kingsbury of a first interruptible operation thus configured. The Applicants, therefore, request that the Examiner specifically point out which parts of Kingsbury are thought to teach each of the limitations “*the first*
5 *uninterruptible operation*,” “*the second value*,” “*by adding the operand*,” and “*the first instance of the shared first value*,” or allow Claim 12.

The Applicants further believe that Claim 12 is allowable for the reasons discussed above with respect to Claim 1, and Claim 9 from which it depends.

Regarding Claim 13,

10 Claim 13 recites:

13. The method of claim 9, wherein the first uninterruptible operation is configured to generate the second value by subtracting the operand from the first instance of the shared first value.

15 The Examiner rejects Claim 13 on the same grounds as Claim 1. However, the Applicants respectfully point out that Claim 13 includes limitations not found in Claim 1 and not addressed by the Examiner. Specifically, Claim 1 does not include the limitations “*the first uninterruptible operation is configured to generate the second value by subtracting the operand from the first instance of the shared first value*.” The
20 Applicants are unable to identify any teaching within Kingsbury that the first interruptible operation is thus configured. Those parts of Kingsbury suggested by the Examiner as teaching the first uninterruptible operation do not appear to include subtraction. The Applicants, therefore, request that the Examiner specifically point out which parts of Kingsbury are thought to teach each of the limitations “*the first uninterruptible*

operation,” “the second value,” “by subtracting the operand,” and “the first instance of the shared first value,” or allow Claim 13.

The Applicants further believe that Claim 13 is allowable for the reasons discussed above with respect to Claims 1, 9 and 12.

5 Regarding Claim 14,

Claim 14 recites:

14. The method of claim 9, wherein the operand has an absolute value greater than one.

10 The Examiner rejects Claim 14 on the same grounds as Claim 1. However, the Applicants respectfully point out that Claim 14 includes limitations not found in Claim 1 and not addressed by the Examiner. Specifically, Claim 1 does not include the limitations “the operand has an absolute value greater than one.”

The Applicants believe that Kingsbury does not teach that the first interruptible
15 operation includes addition of a value greater than one. Specifically, the text suggested by the Examiner as teaching the first uninterruptible operations specifies that a fixed value of “1” is to be added. The Applicants, therefore, request that the Examiner specifically point out teachings of the limitations of Claim 14, within the cited art, or allow Claim 14.

20 The Applicants further believe that Claim 14 is allowable for the reasons discussed above with respect to Claim 9 from which it depends.

Regarding Claim 15,

Claim 15 recites:

25 *15. The method of claim 9, wherein performing the second uninterruptible operation includes using a negative of the operand.*

The Examiner rejects Claim 15 on the same grounds as Claim 1. However, the Applicants respectfully point out that Claim 15 includes limitations not found in Claim 1 and not addressed by the Examiner. Specifically, Claim 1 does not include the limitations “*performing the second uninterruptible operation includes using a negative of the operand.*” The Applicants are unable to identify any teaching within Kingsbury that the second uninterruptible operations involve a negative of the operand of the first uninterruptible operation. The Applicants, therefore, request that the Examiner specifically point out teachings of the limitations of Claim 15, within the cited art, or allow Claim 15.

The Applicants further believe that Claim 15 is allowable for the reasons discussed above with respect to Claim 9 from which it depends.

Regarding Claim 16,

Claim 16 recites:

16. The method of claim 9, further including choosing the first affected reservation location on which to perform the first uninterruptible operation, responsive to whether the method is being used to perform a subtraction or addition.

The Examiner rejects Claim 16 on the same grounds as Claim 1. However, the Applicants respectfully point out that Claim 16 includes limitations not found in Claim 1 and not addressed by the Examiner. Specifically, Claim 1 does not include the limitations “*choosing the first affected reservation location on which to perform the first uninterruptible operation, responsive to whether the method is being used to perform a subtraction or addition.*” The Applicants are unable to identify any teaching within Kingsbury that a reservation location is chosen based on the type of operation involved.

The Applicants, therefore, request that the Examiner specifically point out teachings of the limitations of Claim 16 within the cited art, or allow Claim 16.

Regarding Claim 17,

Claim 17 recites:

- 5 17. *The system of claim 1, further including means for choosing the first affected reservation location on which to perform the first uninterruptible operation, responsive to whether the method is being used to perform a subtraction or addition.*

The Examiner rejects Claim 17 on the same grounds as Claim 1. However, the

- 10 Applicants respectfully point out that Claim 17 includes limitations not found in Claim 1, and not addressed by the Examiner. Specifically, Claim 1 does not include the limitations “*means for choosing the first affected reservation location on which to perform the first uninterruptible operation, responsive to whether the method is being used to perform a subtraction or addition.*” The Applicants are unable to identify any
- 15 teaching within Kingsbury that a reservation location is chosen based on the type of operation involved. The Applicants, therefore, request that the Examiner specifically point out teachings of the limitations of Claim 17 within the cited art, or allow Claim 17.

Conclusion

In view of the above remarks, the pending claims in this application are believed to be in condition for allowance, and the Examiner is respectfully requested to allow the pending claims in this application. The Examiner is invited to call Applicants' representative at the number below if he has any questions or if there are remaining outstanding issues.

Respectfully submitted,

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